

CLAIMS

1 1. An electroacoustic waveguide system, comprising:
2 an acoustic waveguide having an open end and an interior;
3 a first acoustic driver having a first radiating surface and a second radiating
4 surface, constructed and arranged so that said first radiating surface radiates sound waves
5 into free air and said second radiating surface radiates sound waves into said acoustic
6 waveguide so that sound waves are radiated at said open end; and
7 a source of opposing sound waves in said acoustic waveguide for opposing a
8 predetermined spectral component of said sound waves radiated into said acoustic waveguide
9 to oppose the acoustic radiation of said predetermined spectral component from said acoustic
10 waveguide.

2 2. An electroacoustic waveguide system in accordance with claim 1, further
comprising an acoustic port, coupling said interior with free air.

3 3. An electroacoustic waveguide system in accordance with claim 1, wherein said
predetermined spectral component comprises the opposition frequency.

4 4. An electroacoustic waveguide system in accordance with claim 1, wherein said
source of opposing sound waves comprises a reflective surface inside said acoustic
waveguide, positioned so that sound waves reflected from said reflective surface oppose said
sound waves radiated directly into said acoustic waveguide by said second radiating surface.

5 5. An electroacoustic waveguide system in accordance with claim 1, wherein said
source of opposing sound waves comprises a second acoustic driver arranged and constructed
to radiate sound waves into said acoustic waveguide.

6 6. An electroacoustic waveguide system in accordance with claim 5, further
comprising an acoustic port, coupling said interior with free air.

1 7. An electroacoustic waveguide system in accordance with claim 6, wherein said
2 acoustic waveguide has a closed end and said acoustic port is positioned between said first
3 acoustic driver and said closed end of said acoustic waveguide.

1 8. An electroacoustic waveguide system in accordance with claim 1, wherein said
2 predetermined spectral component comprises a dip frequency at which said waveguide
3 system produces an acoustic null, absent said source of opposing sound waves.

1 9. An electroacoustic waveguide system in accordance with claim 8, wherein said
2 source of opposing sound waves comprises a reflective surface inside said acoustic
3 waveguide, positioned so that sound waves reflected from said reflective surface opposes
4 said sound waves radiated directly into said acoustic waveguide by said second radiating
5 surface.
6

1 10. An electroacoustic waveguide system in accordance with claim 8, wherein said
2 source of opposing sound waves comprises a second acoustic driver arranged and constructed
3 to radiate sound waves into said acoustic waveguide.
4

1 11. An electroacoustic waveguide system, comprising:
2 an acoustic waveguide having an open end and a closed end and further
3 having an effective length;
4 an acoustic driver for radiating sound waves into said waveguide, positioned
5 in said acoustic waveguide so that there is an acoustic null at said open end at a dip
6 frequency.

1 12. An electroacoustic waveguide system in accordance with claim 11, said acoustic
2 waveguide having a substantially constant cross section, wherein said acoustic driver is
3 positioned at a distance substantially $0.25L$ from said closed end of said waveguide, where L
4 is the effective length of said waveguide.

1 13. An electroacoustic waveguide system in accordance with claim 12, wherein said
2 closed end is a surface that is acoustically reflective at said dip frequency.

1 14. An electroacoustic waveguide system comprising:
2 an acoustic waveguide having an open end and a closed end and a wall
3 connecting said open end and said closed end;
4 a plurality of acoustic drivers, each having a first radiating surface and a
5 second radiating surface;
6 wherein a first of said acoustic drivers is placed in said wall of said acoustic
7 waveguide so that said first radiating surface of said first acoustic driver radiates into said
8 acoustic waveguide and said second radiating surface of said first acoustic driver radiates
9 into free air.

10 15. An electroacoustic waveguide system in accordance with claim 14, wherein a
11 second of said acoustic drivers is positioned in said closed end of said acoustic waveguide.

12 16. An electroacoustic waveguide system in accordance with claim 14, wherein a
13 second of said plurality of acoustic drivers is placed in said wall of said acoustic waveguide
14 so that said first radiating surface of said second driver radiates into said acoustic waveguide
15 and said second radiating surface of said second acoustic driver radiates into free air.

16 17. A method for radiating with the apparatus of claim 14 by combining radiation of
17 said plurality of acoustic drivers to produce an acoustic null at the open end of said
18 waveguide at a dip frequency.

19 18. An electroacoustic waveguide system comprising:
20 an acoustic waveguide;
21 an acoustic driver; and
22 an acoustic low-pass filter intercoupling said acoustic driver and said acoustic
23 waveguide.

1 19. An electroacoustic waveguide system in accordance with claim 18, wherein said
2 acoustic low pass-filter comprises an acoustic compliance between said acoustic driver and
3 said acoustic waveguide.

1 20. An electroacoustic waveguide system comprising:
2 an acoustic waveguide having an open end and a closed end and an effective
3 midpoint;
4 a plurality of acoustic drivers; and
5 an acoustic compliance acoustically coupling a first of said plurality of
6 acoustic drivers and said acoustic waveguide.

1 21. An electroacoustic waveguide system in accordance with claim 20 wherein a first
2 of said plurality of acoustic drivers is positioned at approximately said effective midpoint.

1 22. An electroacoustic waveguide system in accordance with claim 20,
2 said acoustic waveguide having a substantially constant cross section,
3 wherein a first of said plurality of acoustic drivers is positioned at a distance
4 substantially $.25L$ from said closed end, where L is the effective length of said acoustic
5 waveguide,
6 and wherein a second of said plurality of acoustic drivers is positioned substantially
7 $.75L$ from said closed end,
8 and an acoustic compliance between said second acoustic driver and said waveguide.

1 23. An electroacoustic waveguide system comprising:
2 an acoustic waveguide having a substantially constant cross section; and
3 a plurality of acoustic drivers placed in said acoustic waveguide so at least two of said
4 acoustic drivers are substantially $0.5L$ apart where L is the effective length of the waveguide.

1 24. An electroacoustic waveguide system in accordance with claim 23 wherein a first
2 of said plurality of acoustic drivers is placed at a position substantially $0.25L$ from said
3 closed end and a second of said acoustic drivers is placed at a position substantially $0.75L$
4 from said closed end, where L is the effective length of the waveguide.

25. A method for operating an acoustic waveguide having an open end and a closed end and a wall connecting said open end and said closed end, comprising, radiating acoustic energy into said acoustic waveguide; and significantly opposing acoustic radiation at a predetermined dip frequency.

26. A method for operating an acoustic waveguide in accordance with claim 25, wherein said opposing acoustic radiation comprises providing opposing acoustic radiation in said acoustic waveguide.

27. A method for operating an acoustic waveguide in accordance with claim 26, wherein said providing opposing acoustic radiation comprises reflecting said radiated acoustic energy off an acoustically reflective surface inside said acoustic waveguide so that said reflected acoustic energy opposes the acoustic energy radiated into said waveguide.

28. A method for operating an acoustic waveguide in accordance with claim 26, wherein said providing opposing acoustic radiation comprises radiating, by a second acoustic driver, said opposing acoustic energy into said acoustic waveguide.